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Title: High Amplitude Non Contact Acoustic Source for Defect Detection and 3-component Excitation

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High Amplitude Non Contact Acoustic Source for Defect Detection and 3-component Excitation

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March 11, 2014

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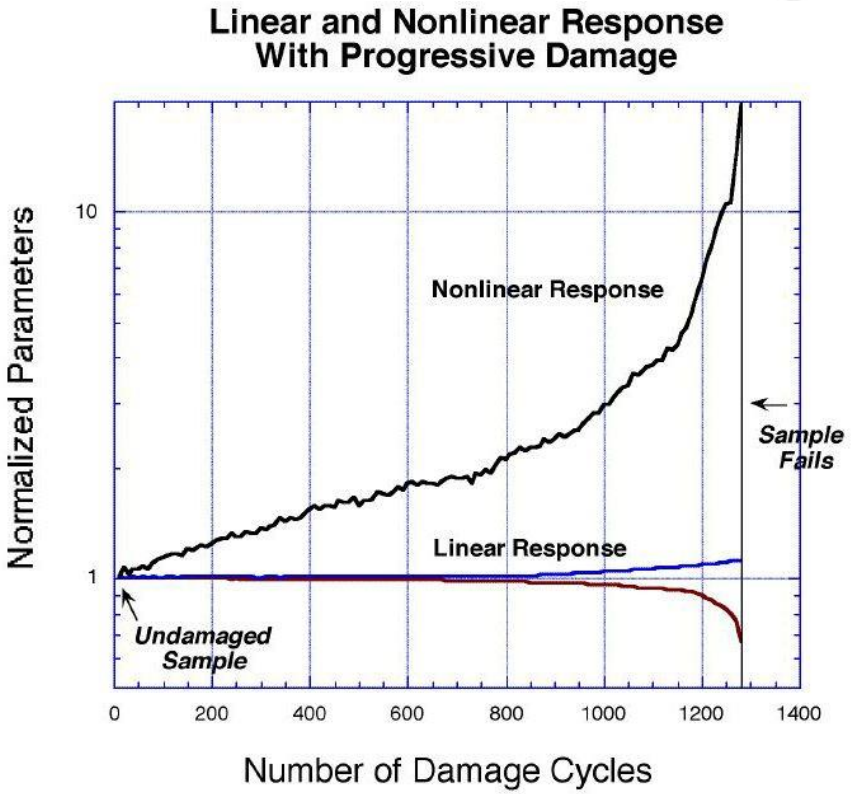
Outline

- Motivation
- Time Reversal basics
- Non contact source basics and first results
- 3 component excitation
- Path forward

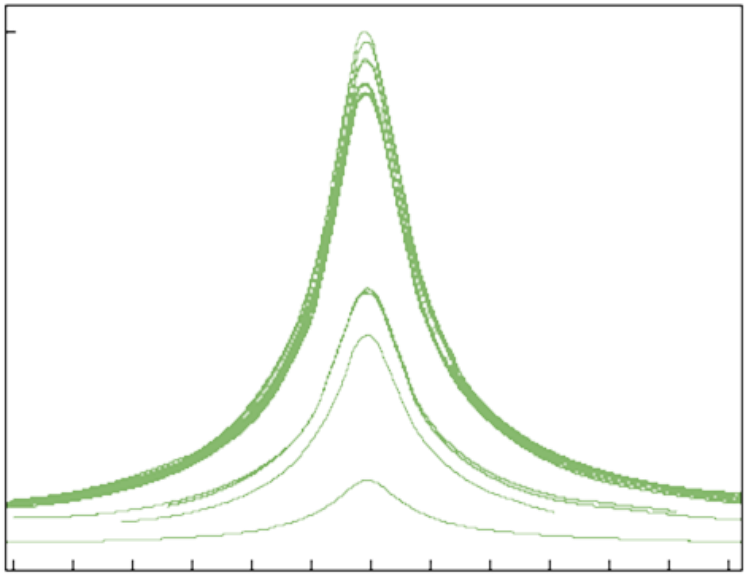
Motivation

Nonlinear acoustics sensitivity to damage

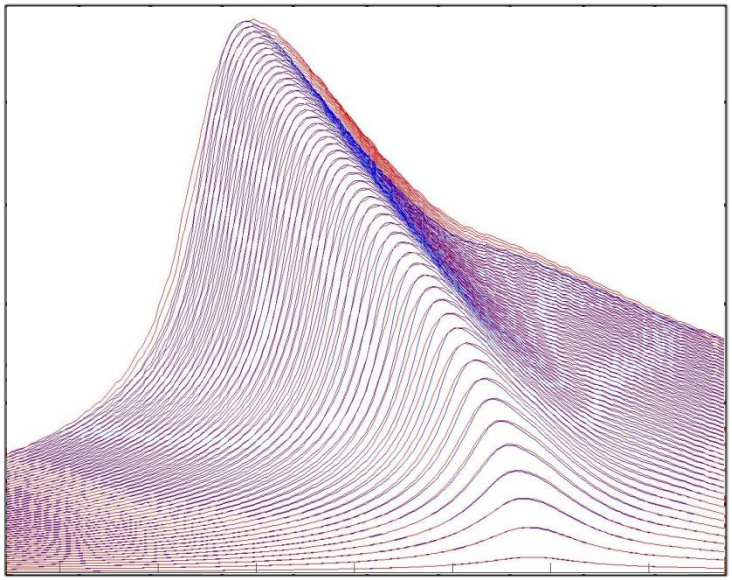


Nonlinear Signatures

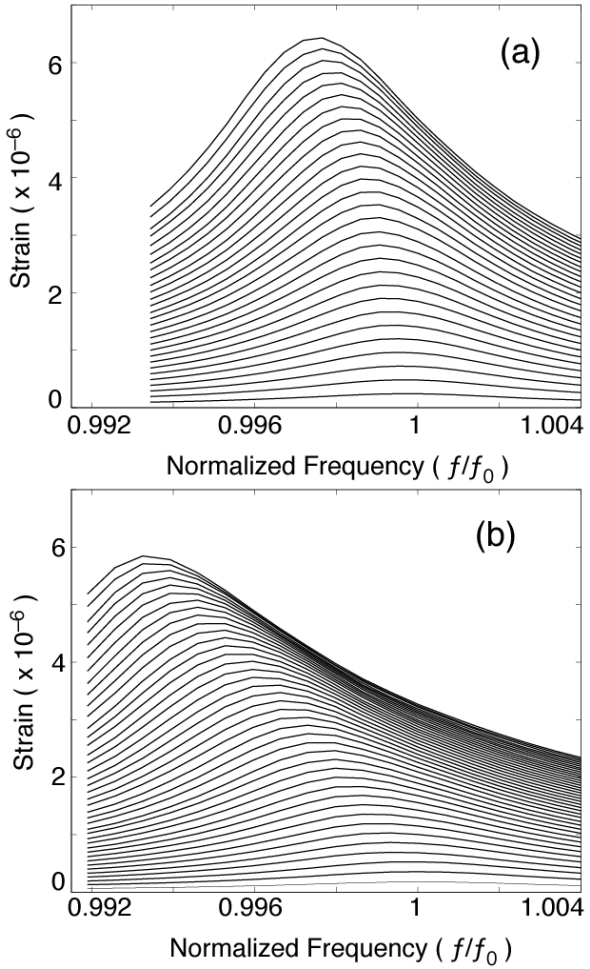
Linear (undamaged)



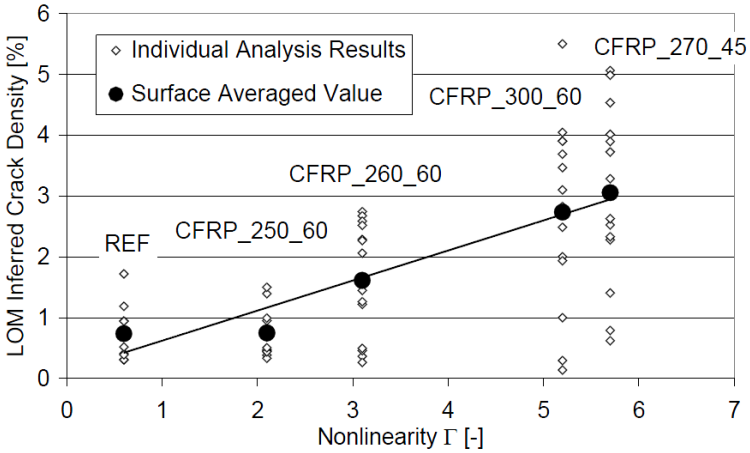
Nonlinear (damaged)

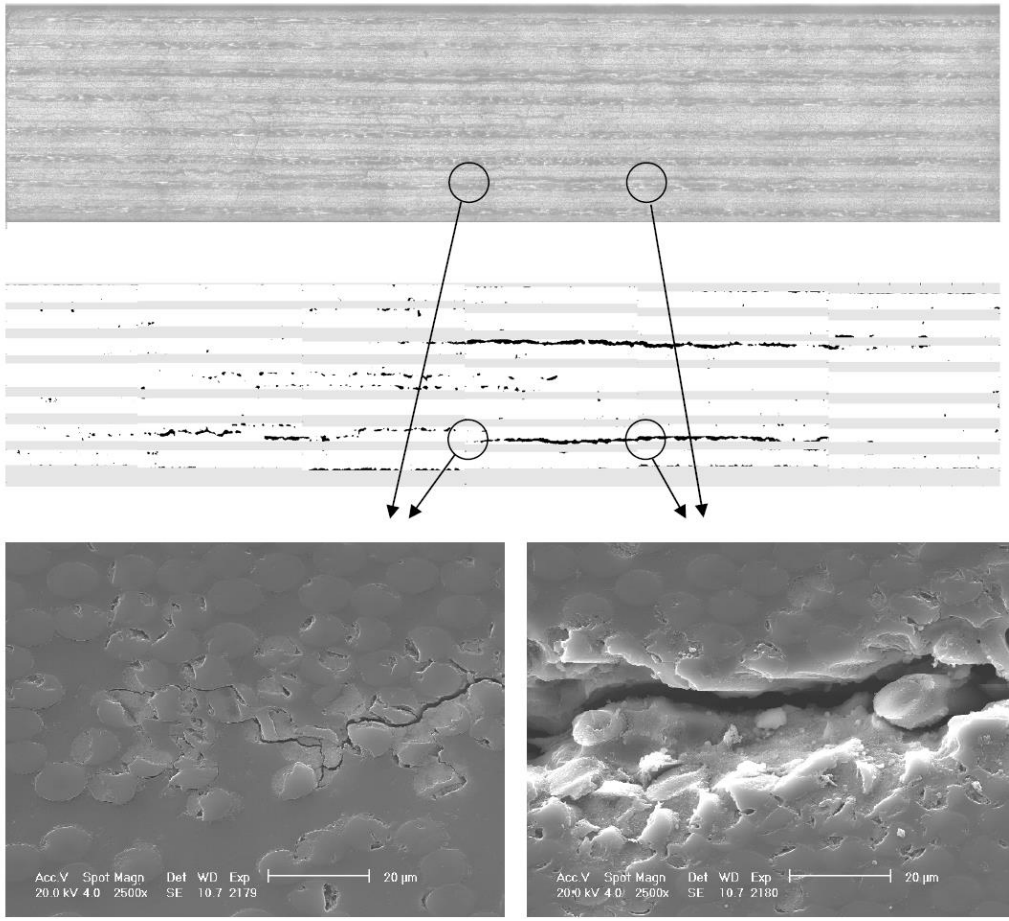


Damage detection in concrete with nonlinear resonances



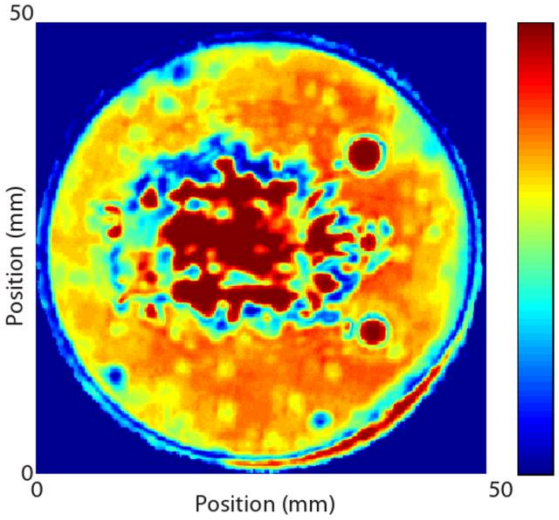
Correlation between damage and nonlinear parameter



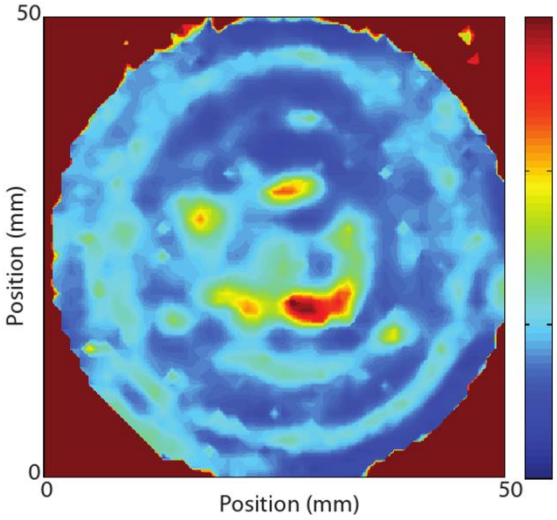


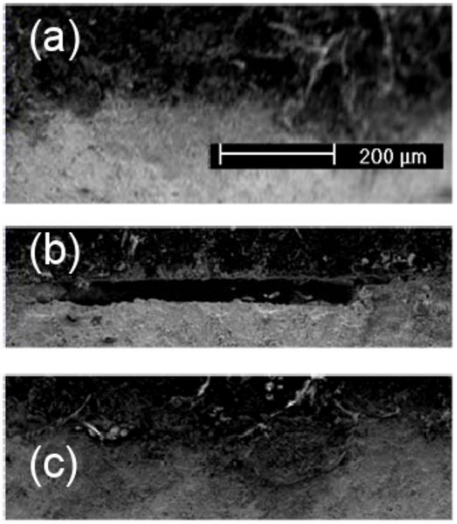
Interface Delamination

Linear



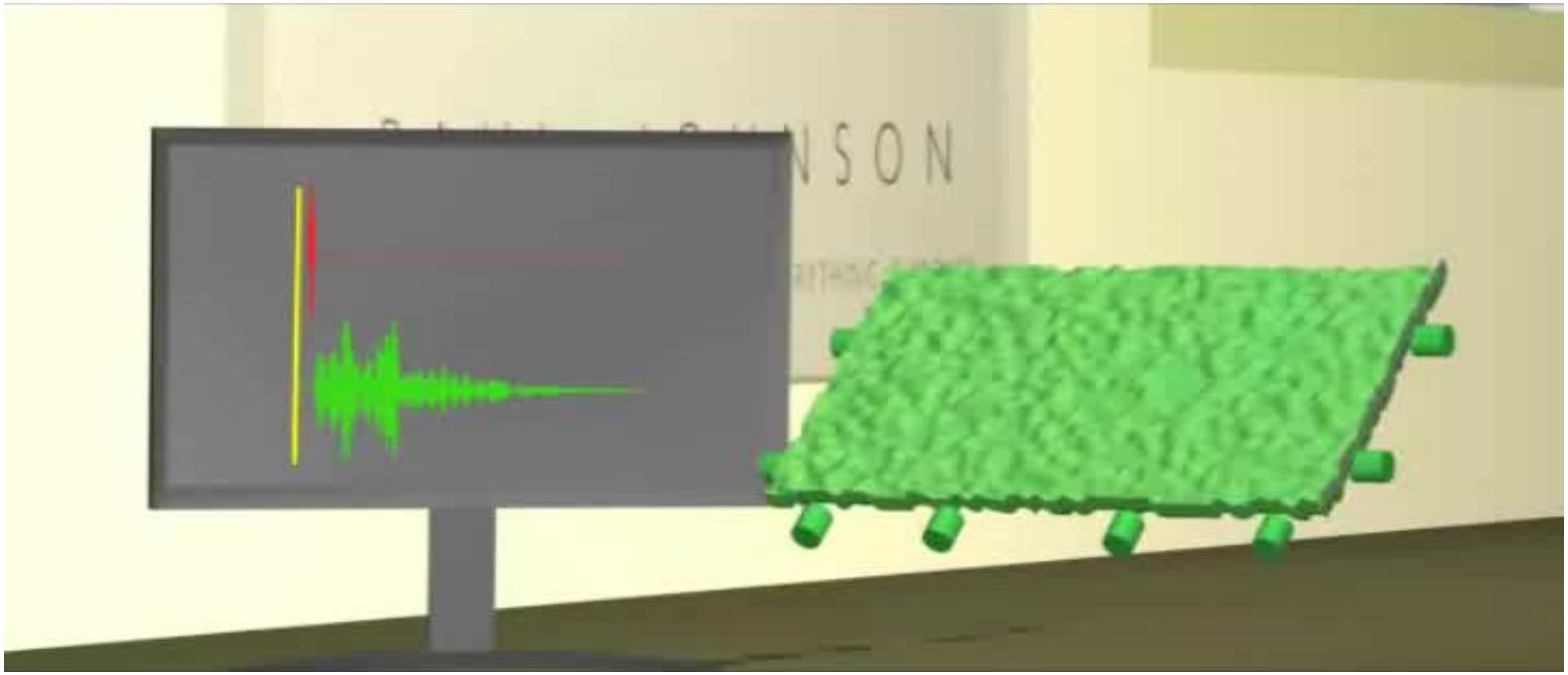
Non Linear





Time Reversal basics

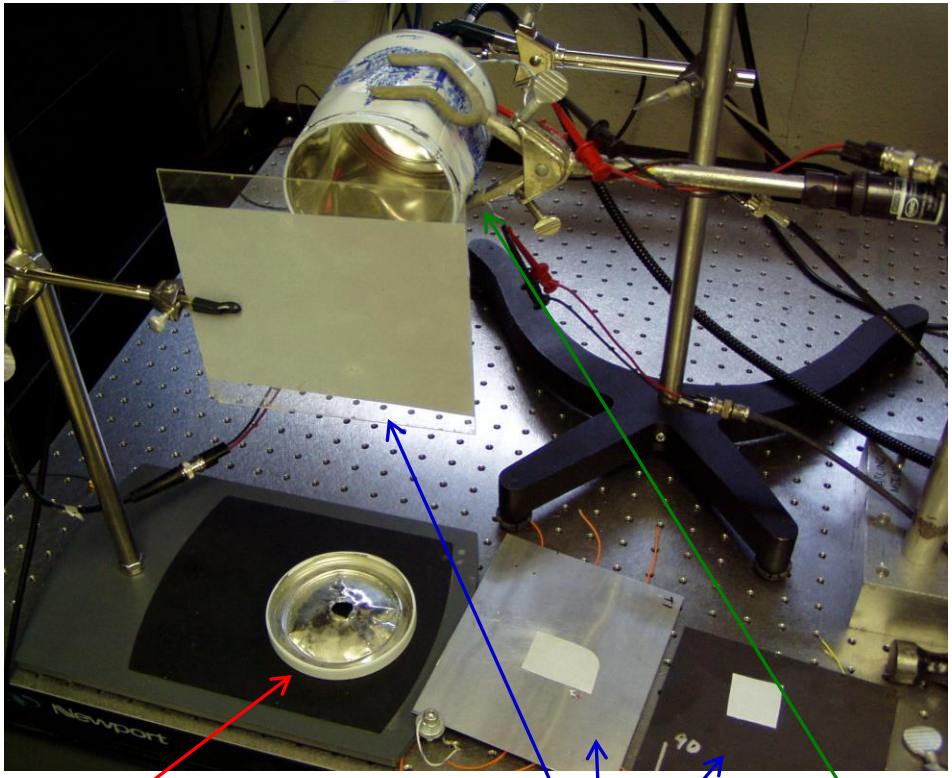
Time Reversal

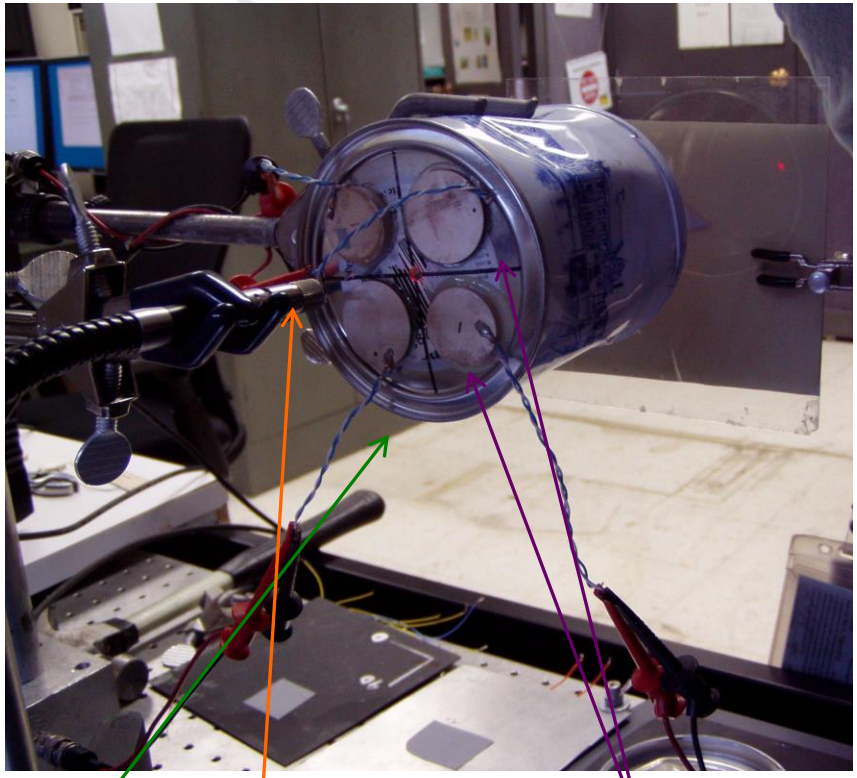


Non contact source basics and first results

Noncontact Source

Prototype Candy Can … or TRANS





Lid

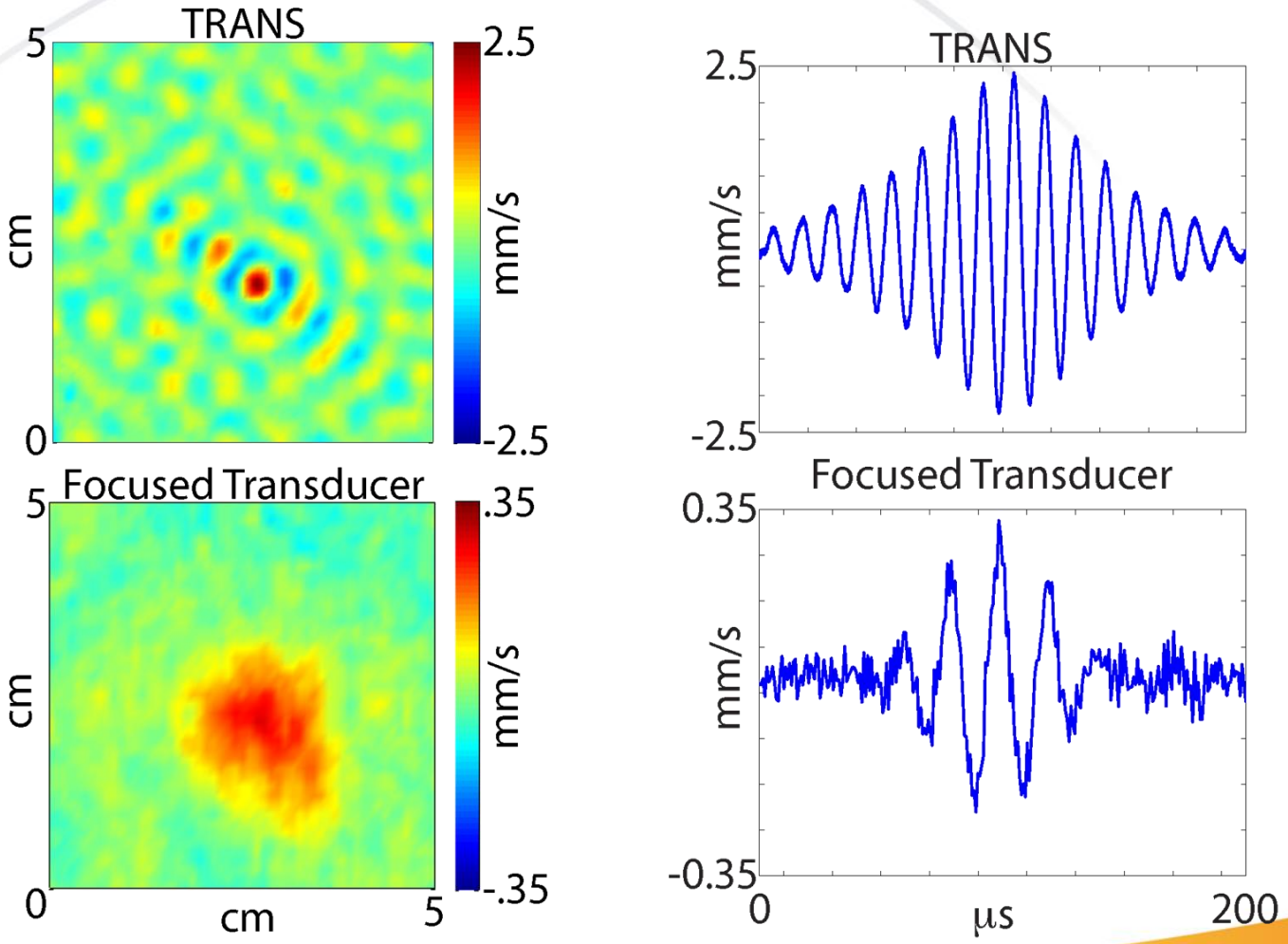
Test Plates

Cavity

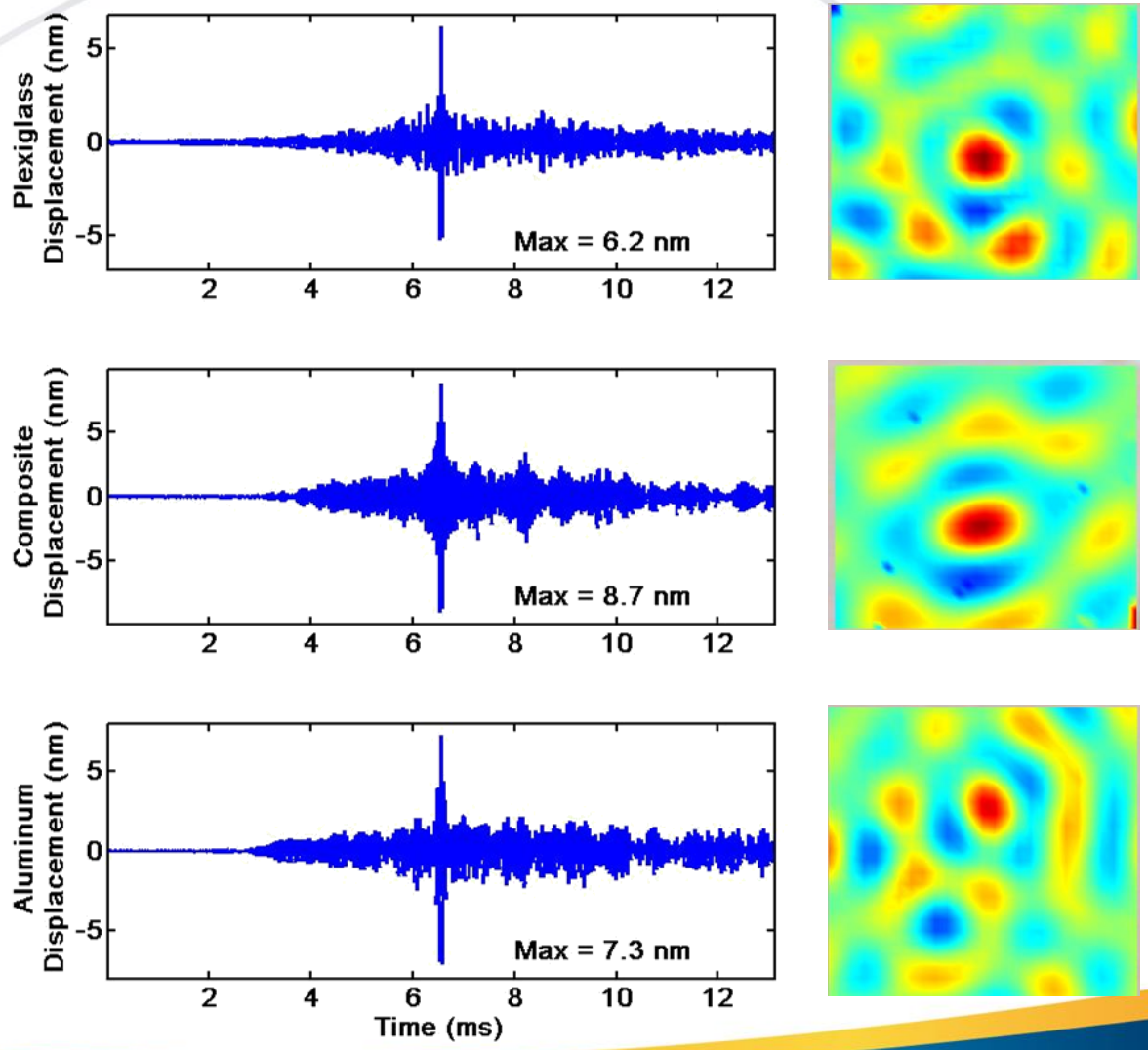
Fiber-optic LV

Transducers

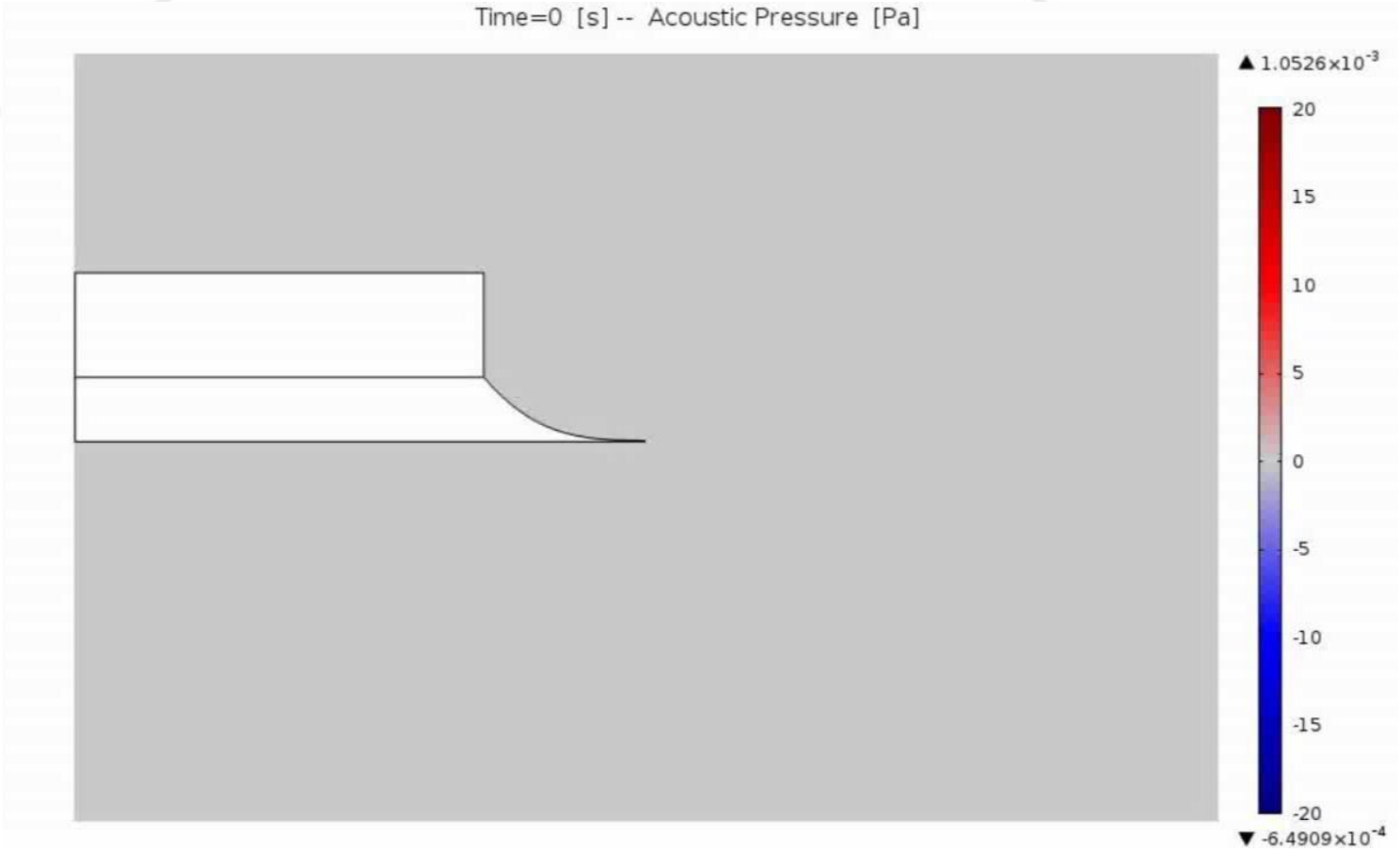
Head to Head: TRANS vs. FUT



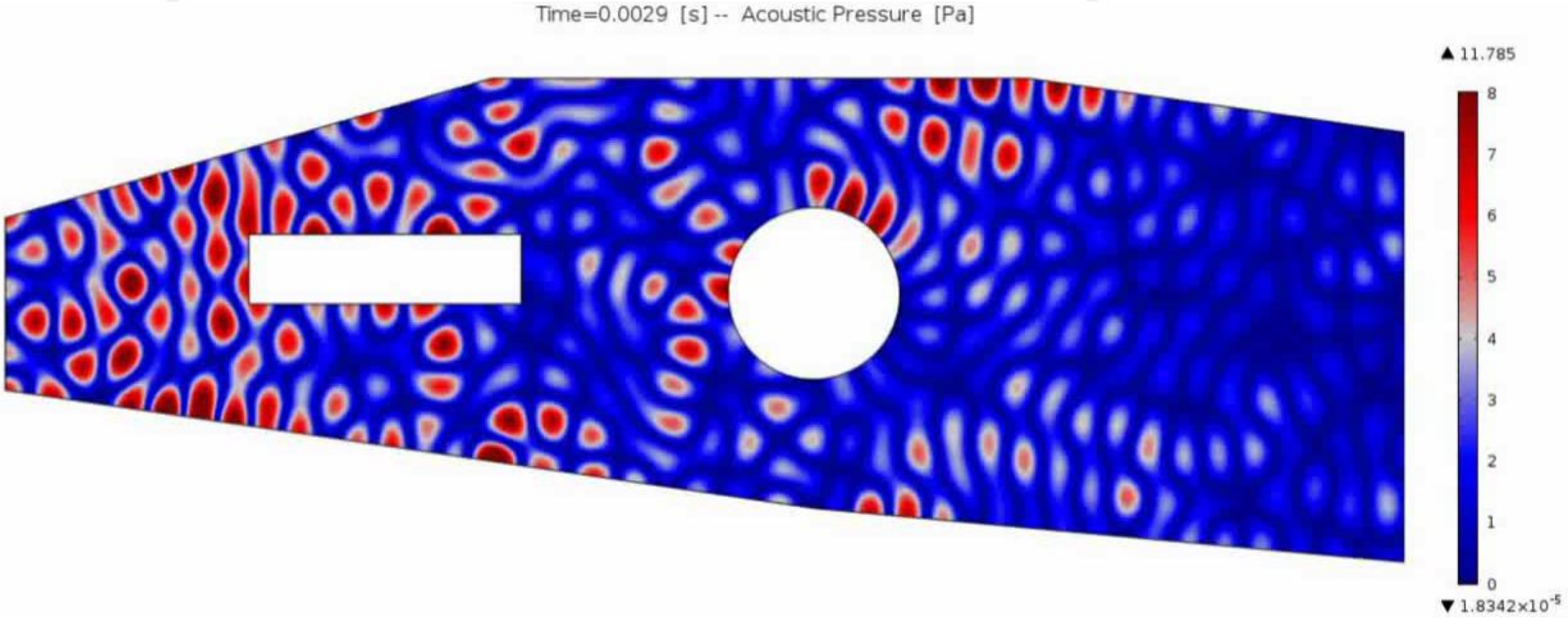
Application to different materials



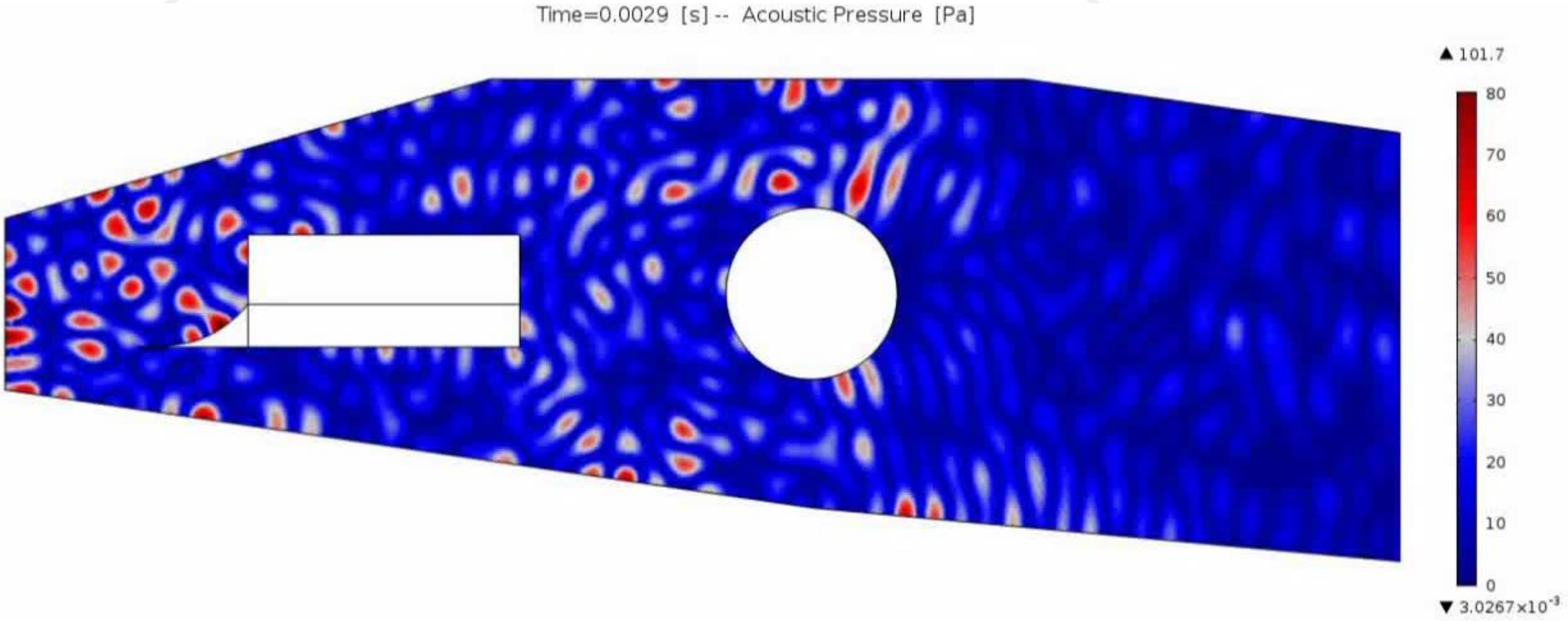
PZT/Air Coupling



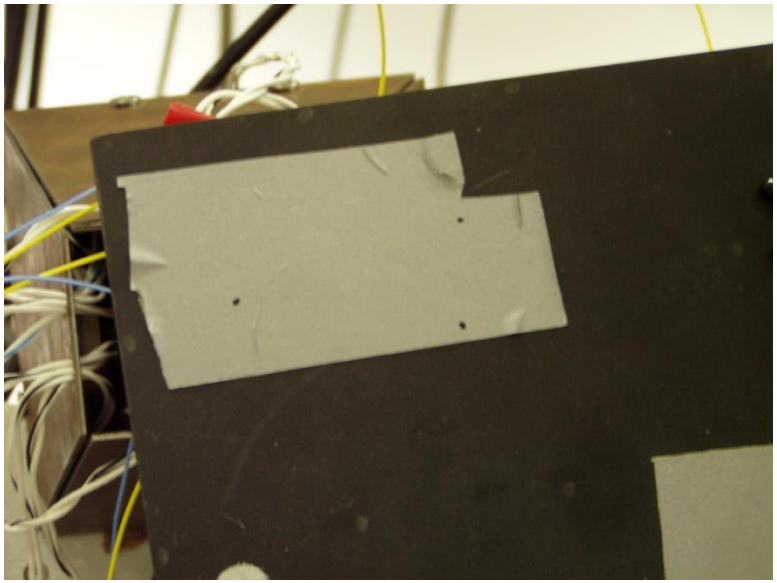
PZT/Air Coupling

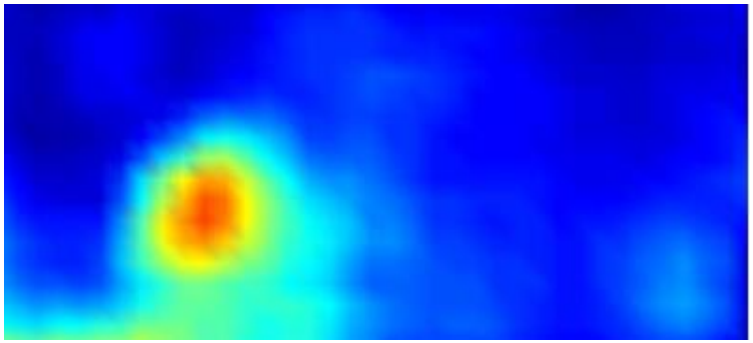


PZT/Air Coupling



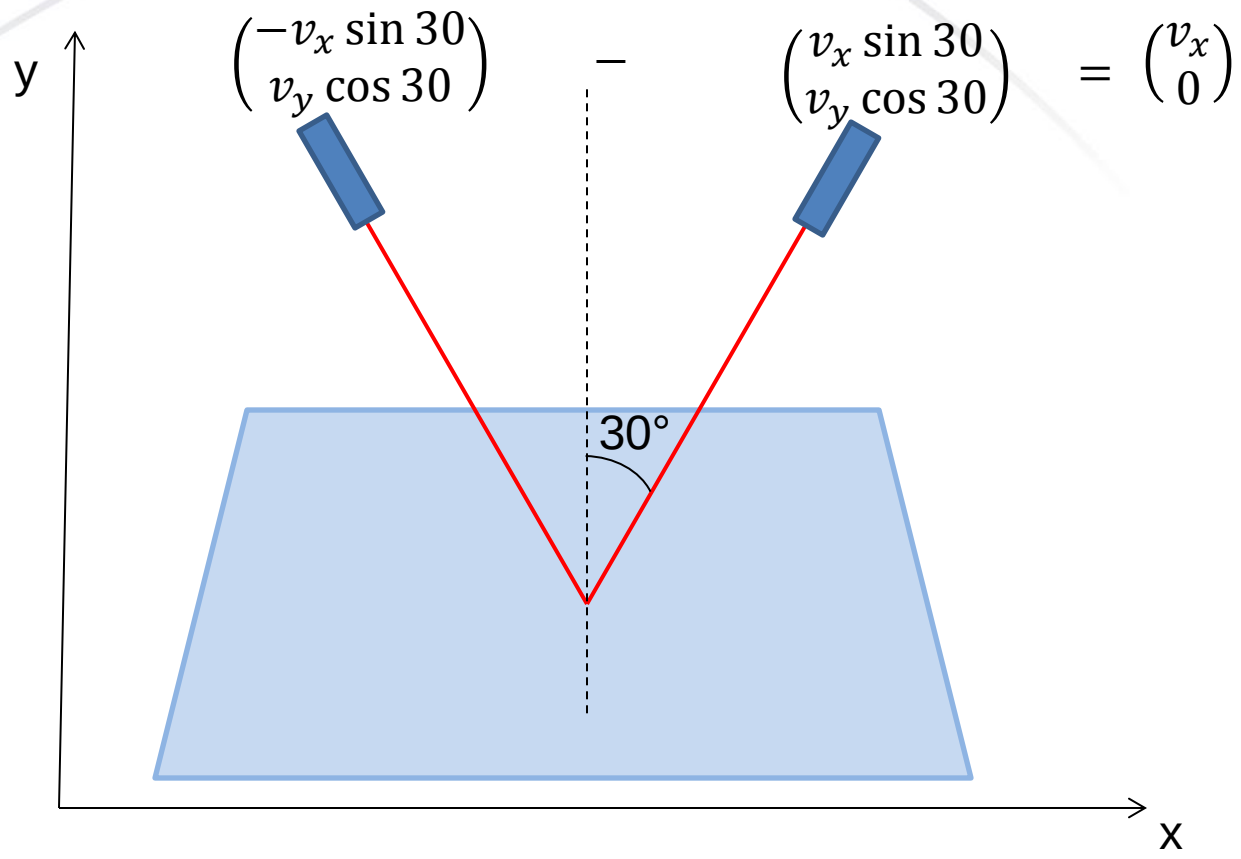
Non-Contact Nonlinear detection of delamination



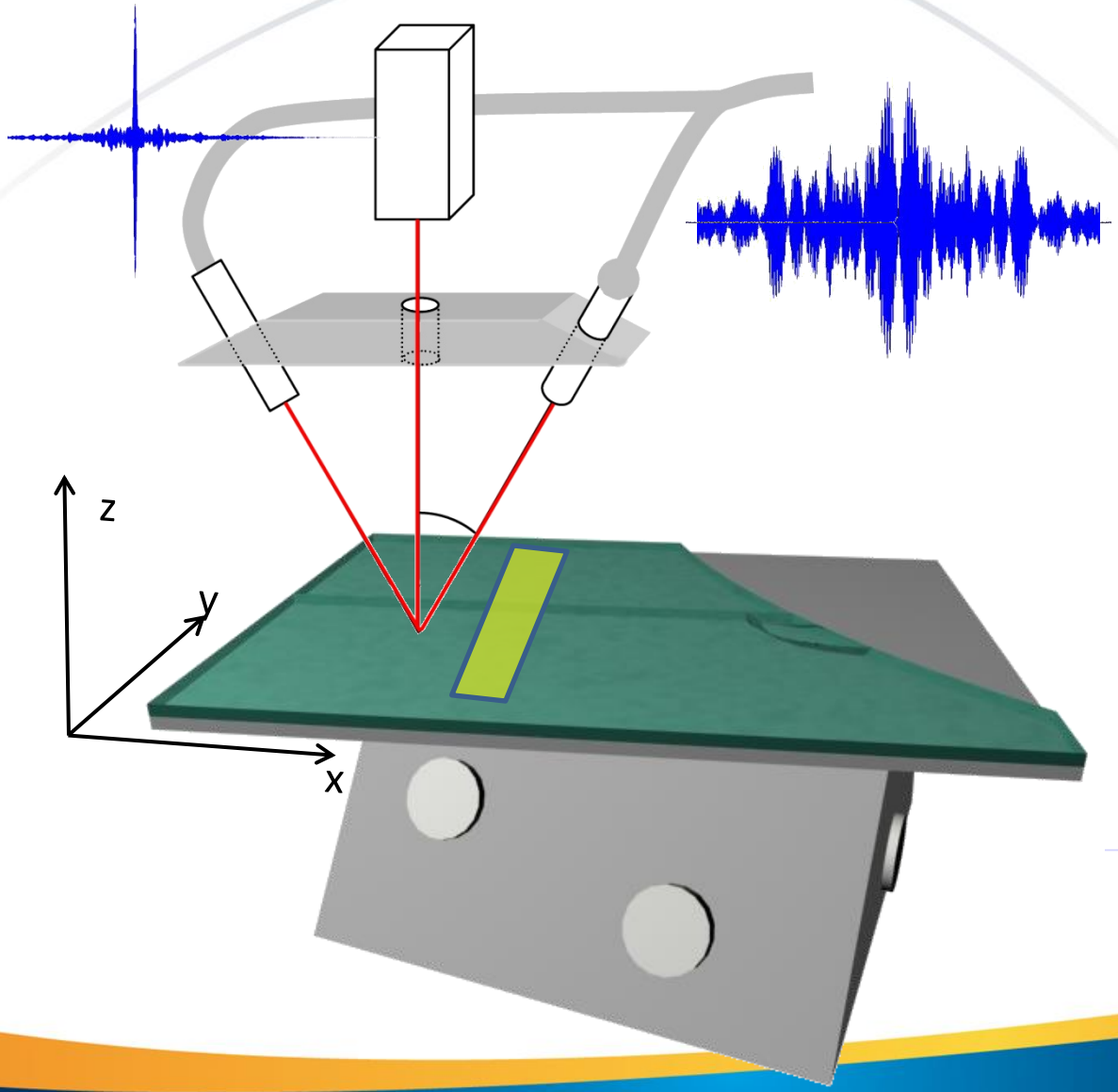


3 component excitation

Measuring In-Plane components



Setup and sample

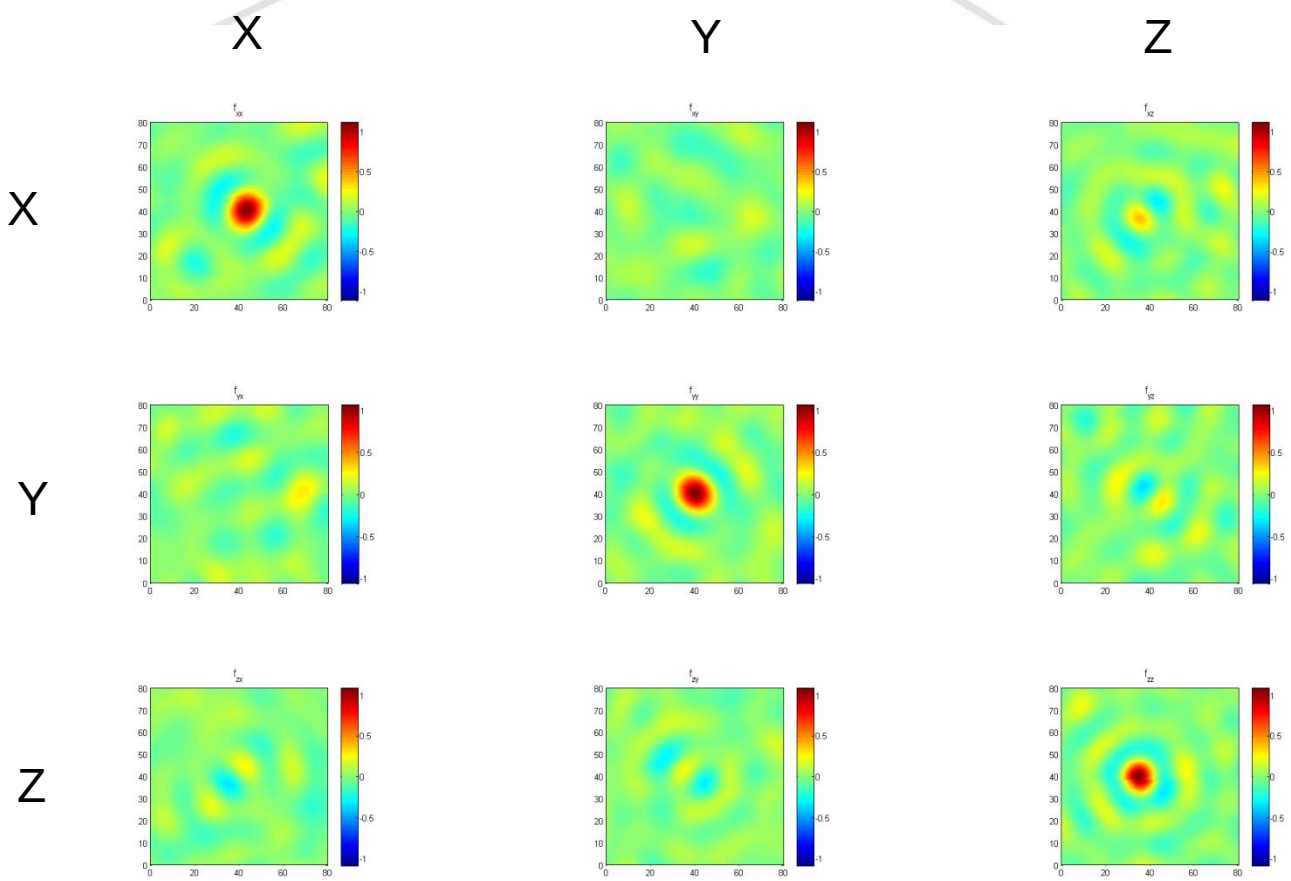


Defects:

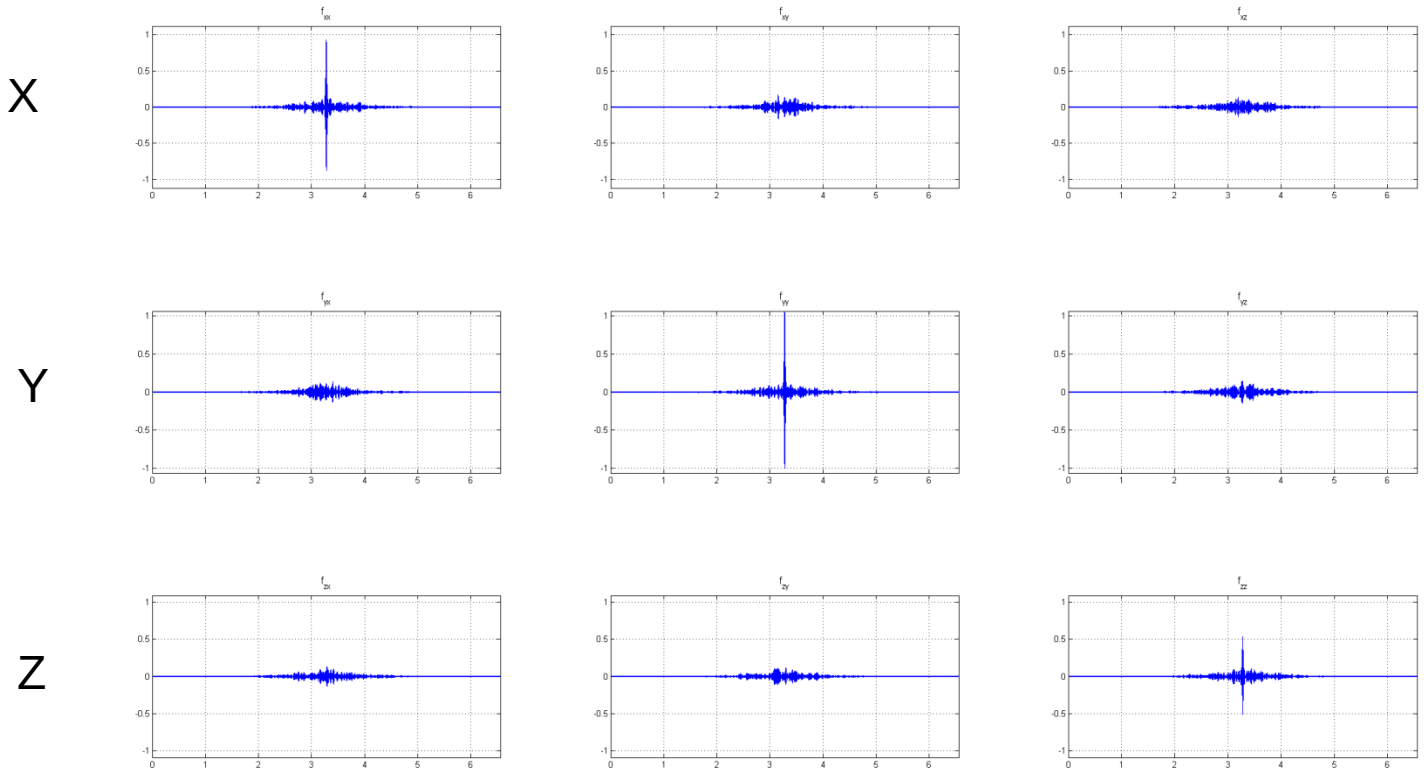
Cracks

Delaminations

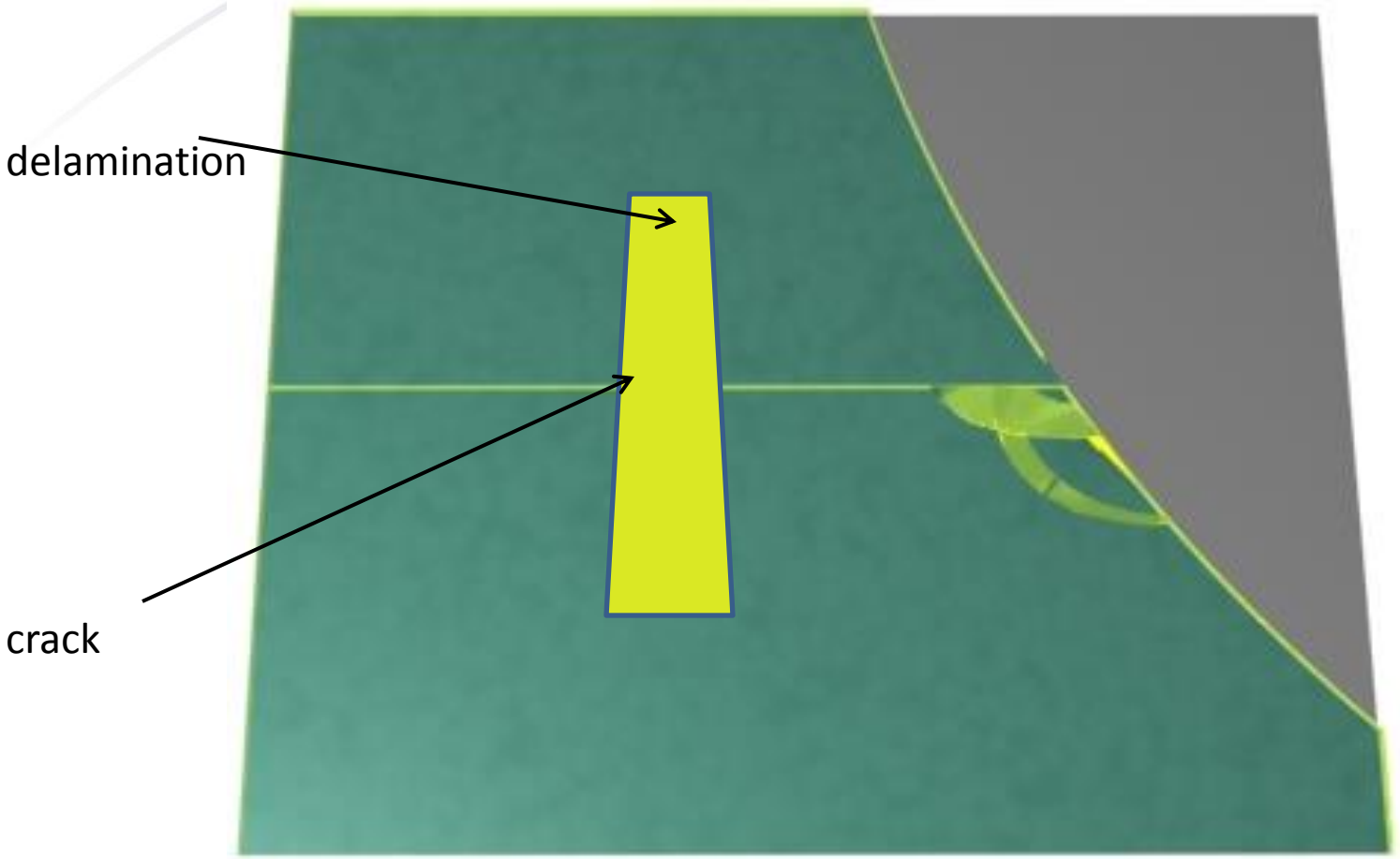
Selected component focus



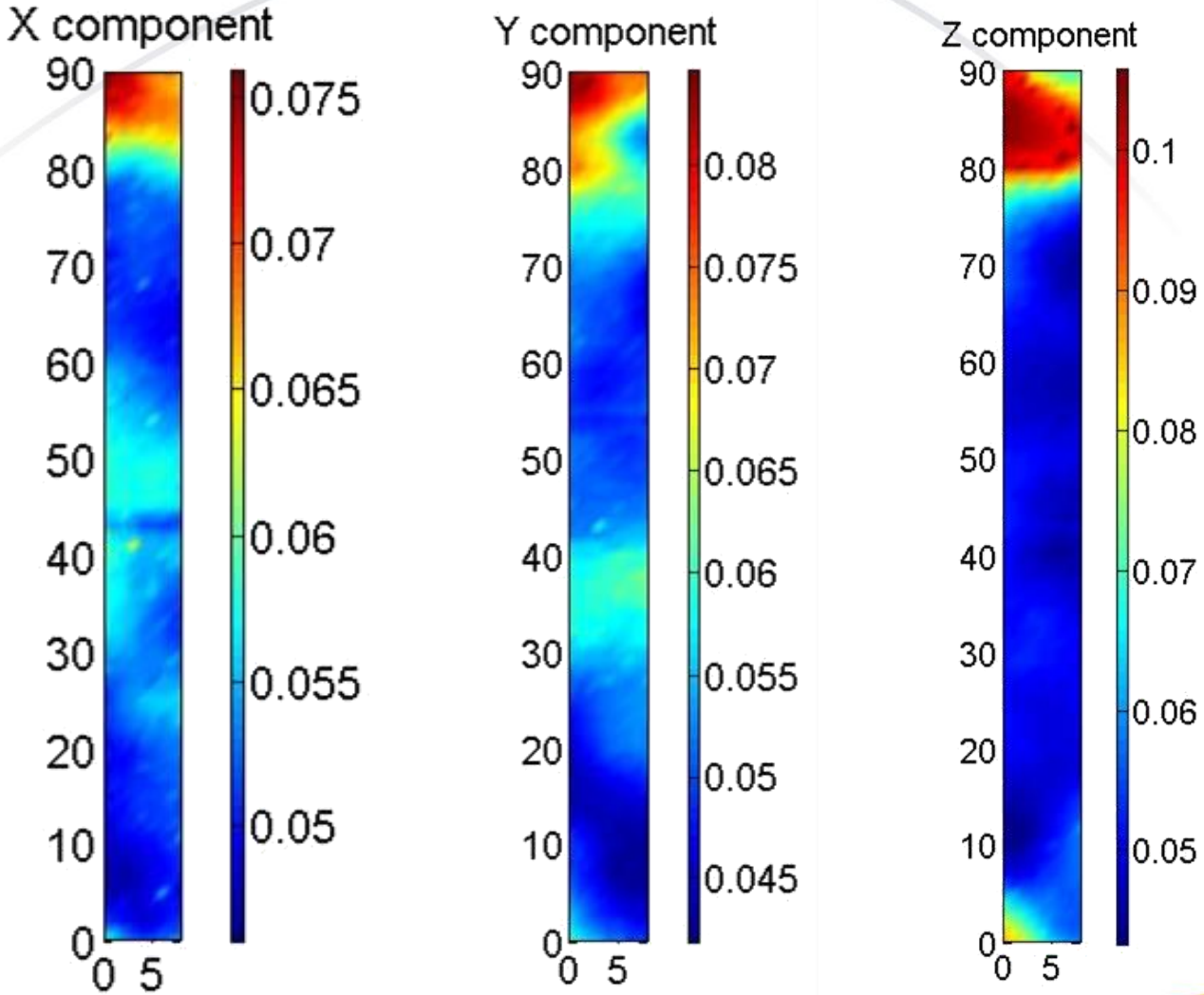
Selected component focus

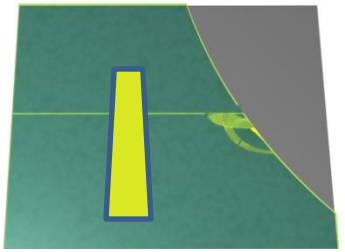


Scan area

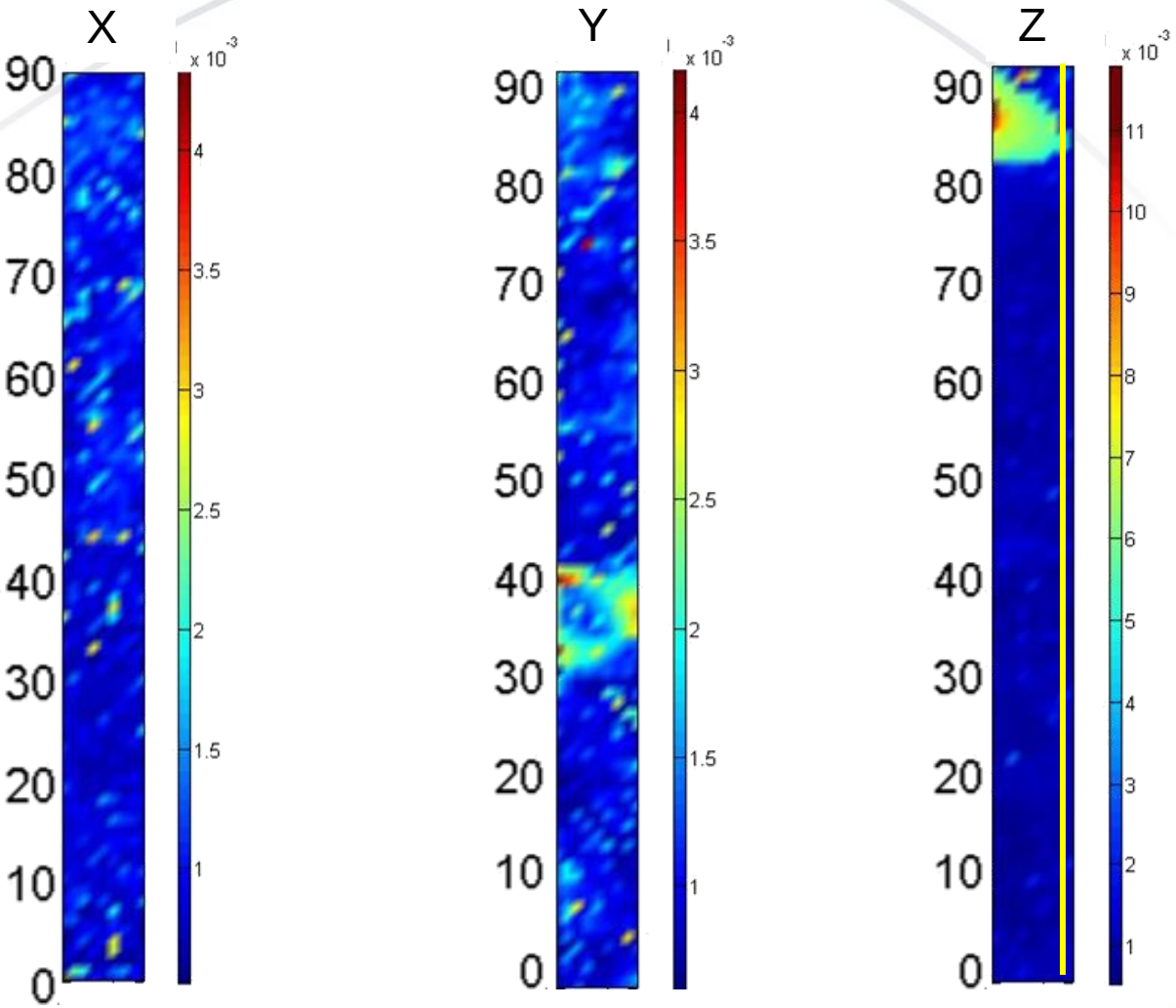


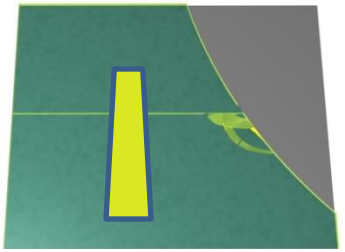
Linear image 75kHz



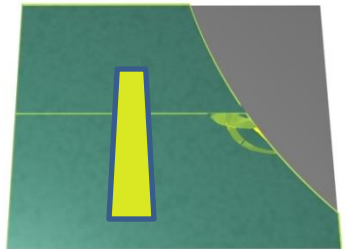


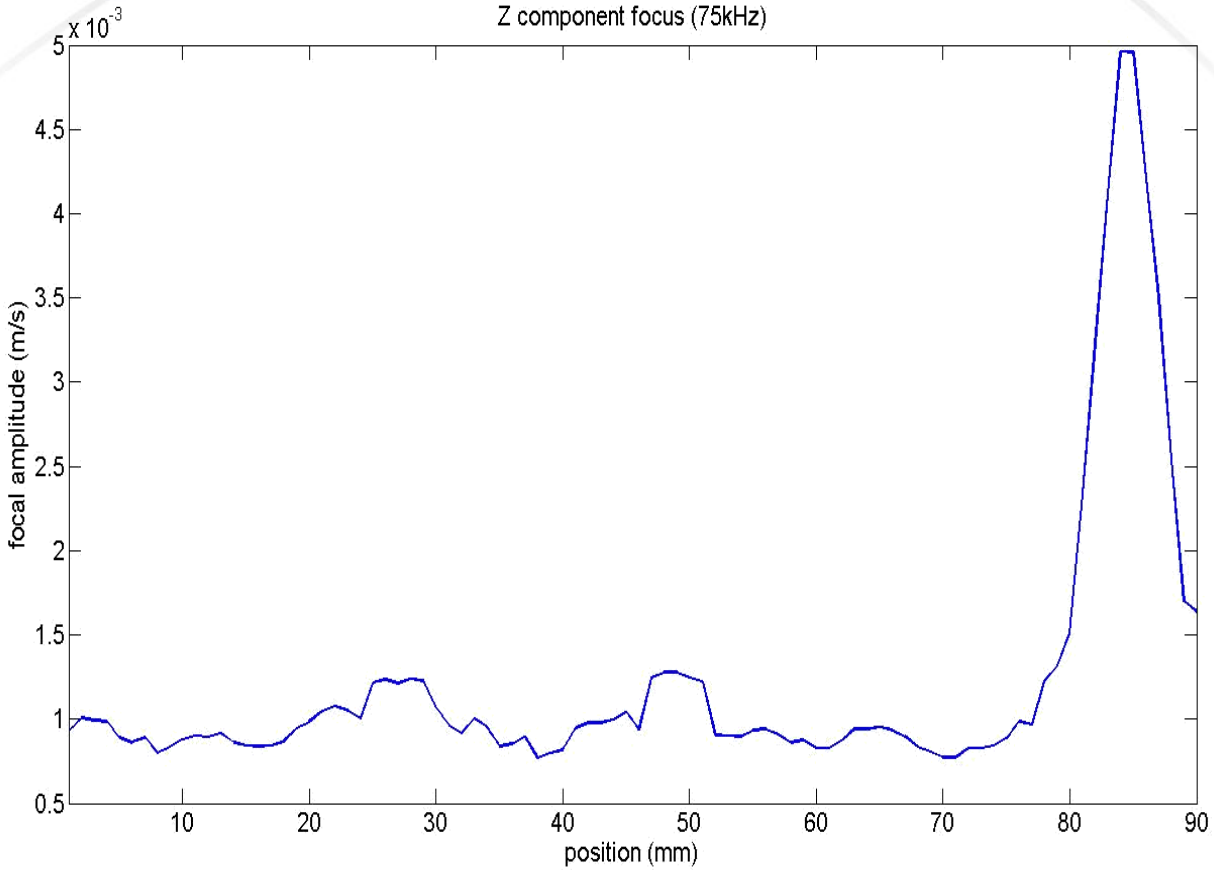
Nonlinear image 75kHz



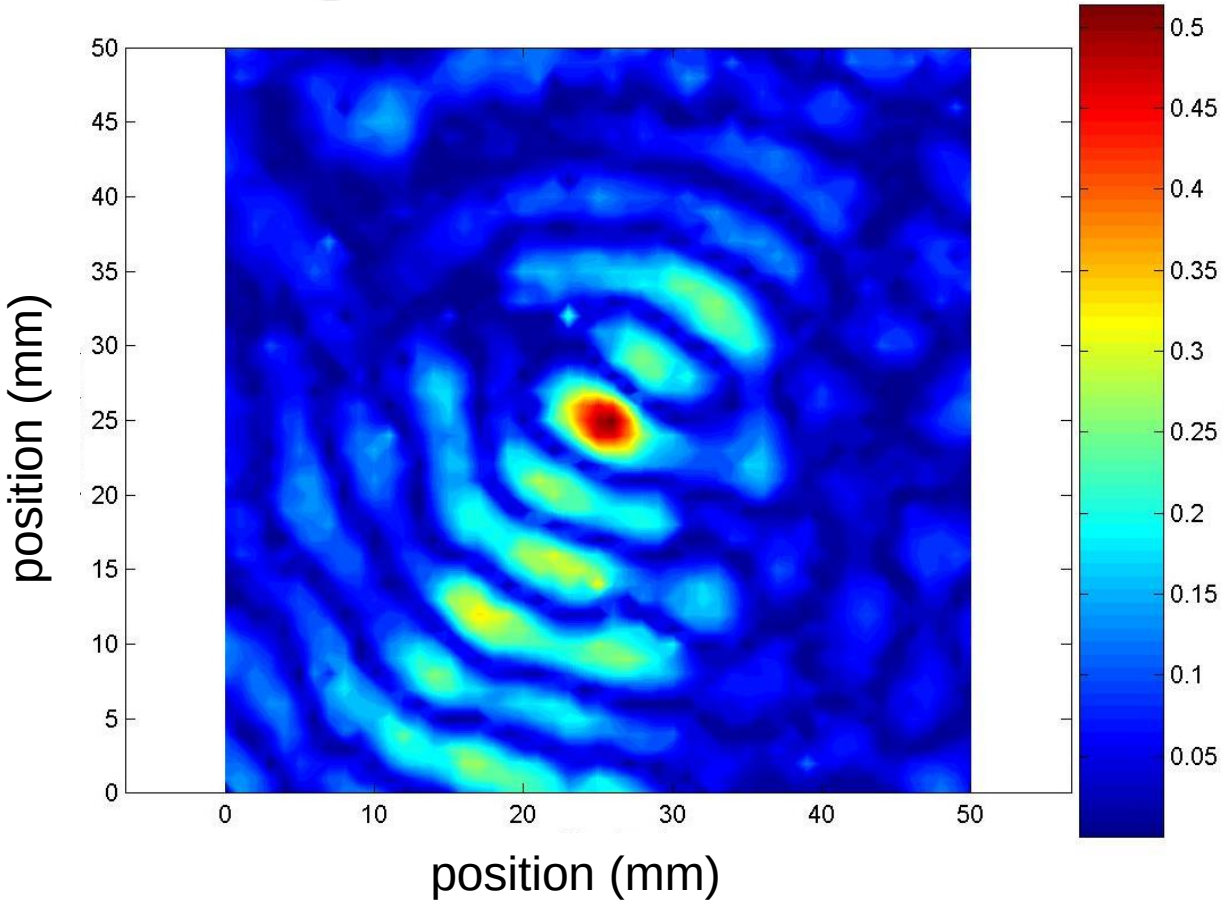


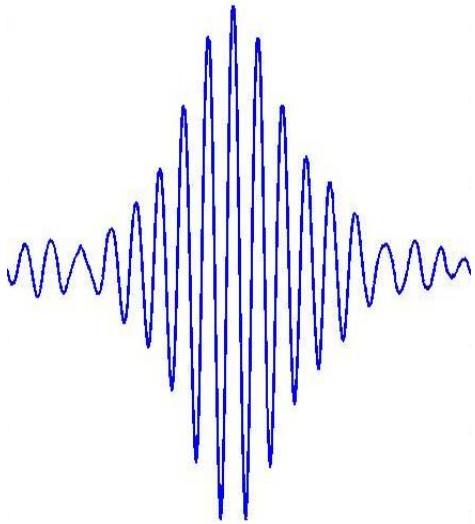
Nonlinear image 75kHz





Multi-component focusing (in-plane result)

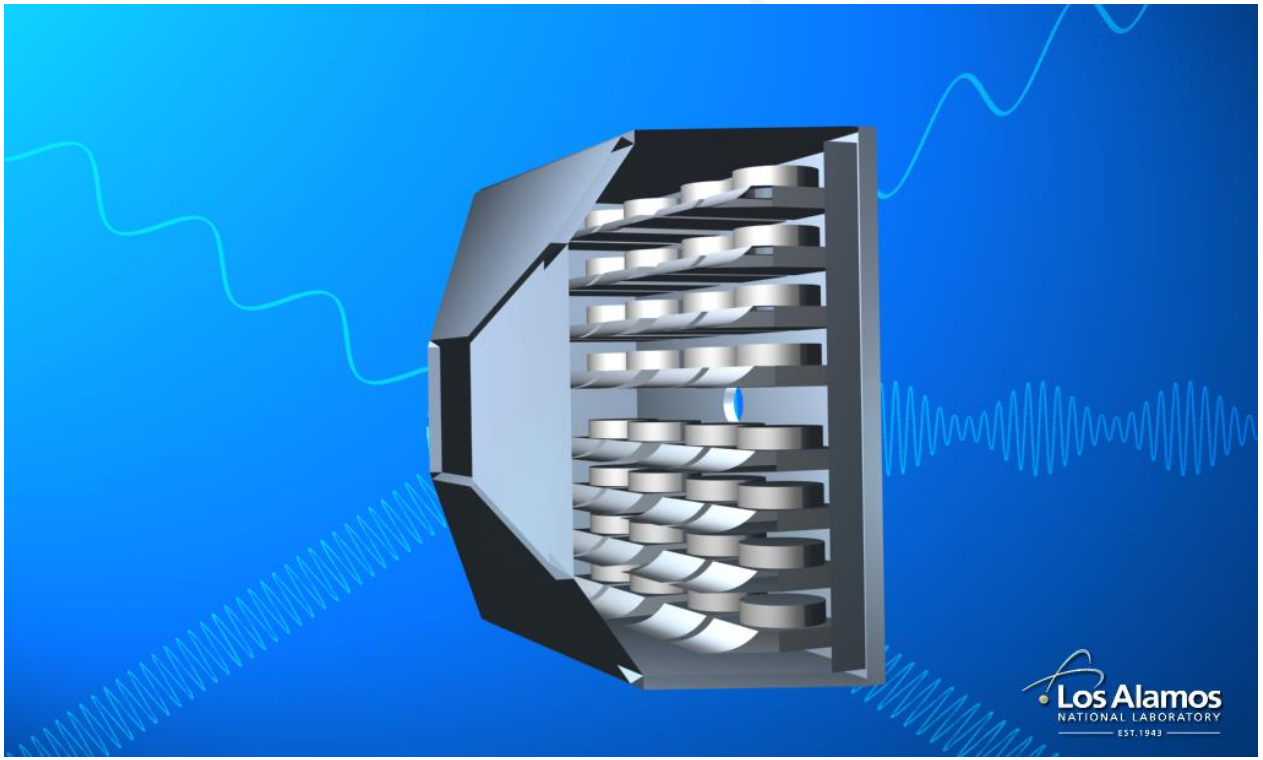




Path forward

New prototype to be tested

- 32 transducers
- Profile to optimize energy transfer to air
- Automated calibration



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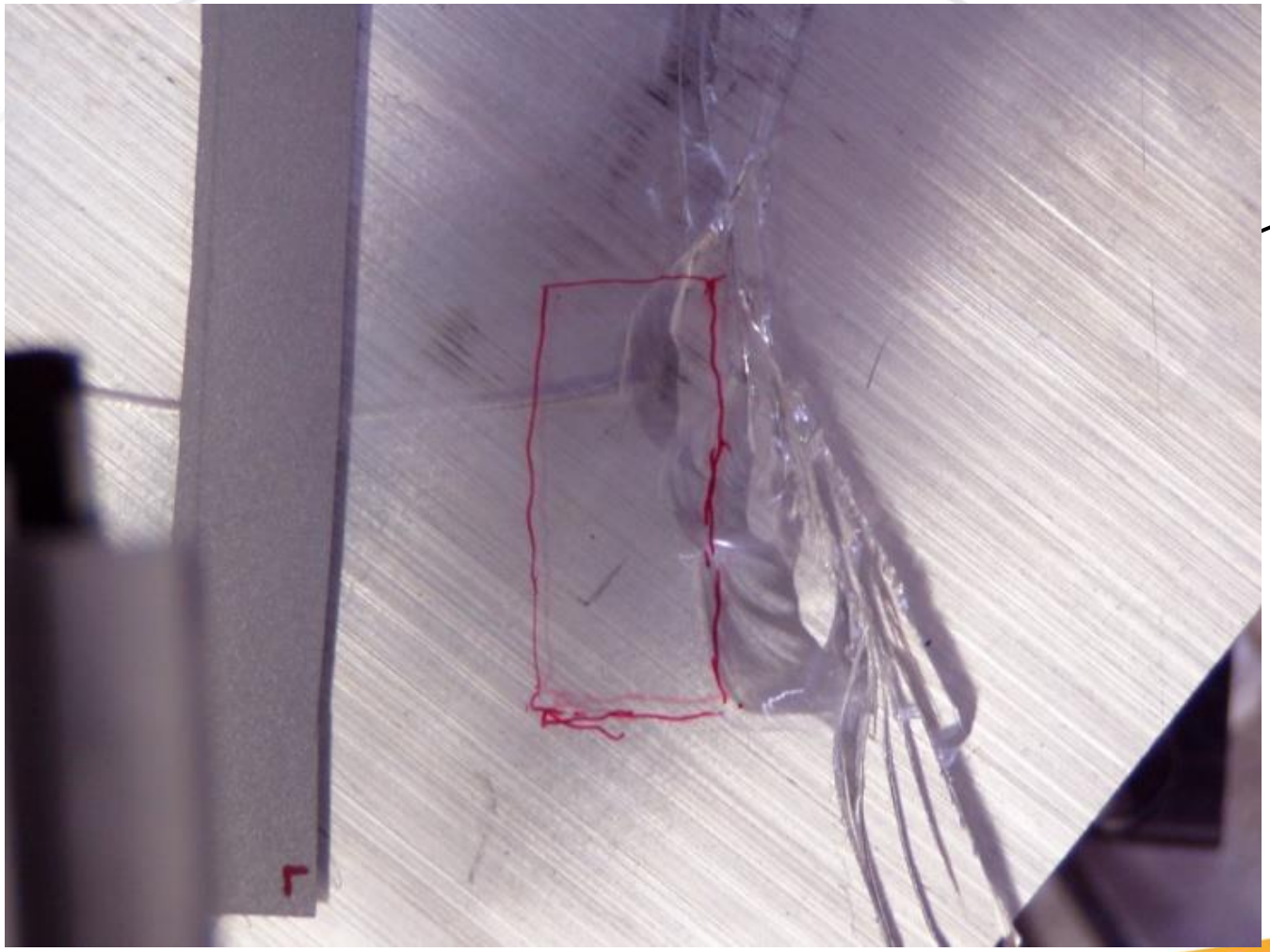
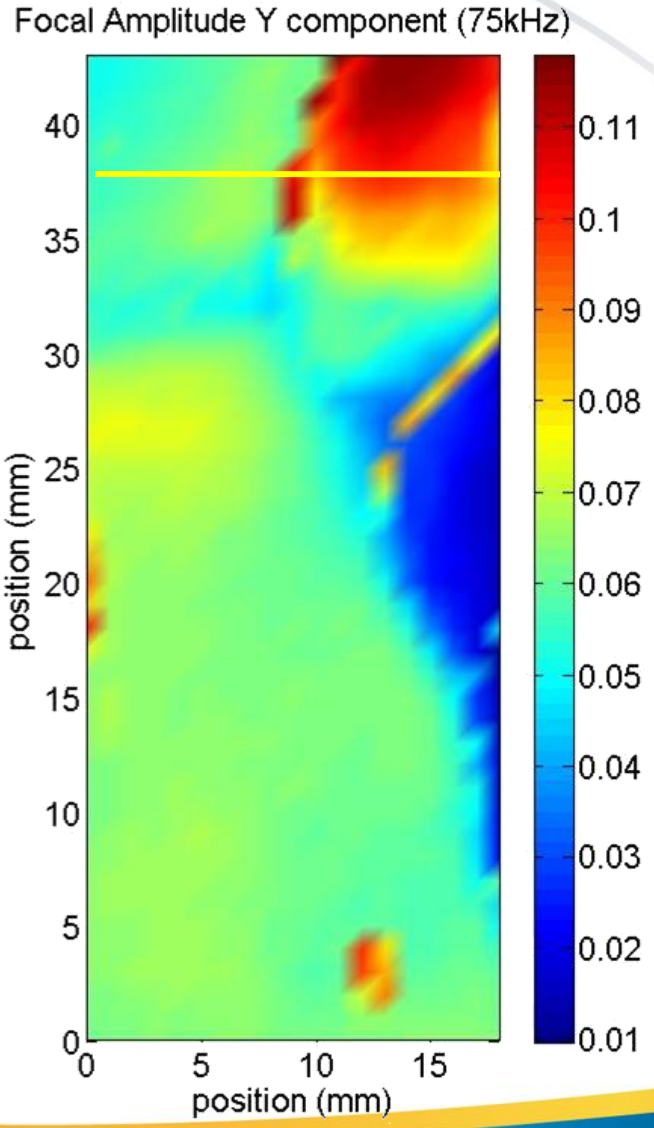
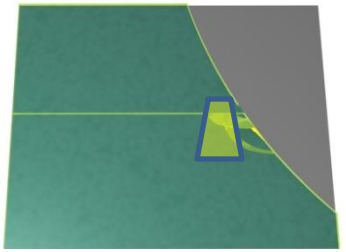
Backup slides

Scan area 2

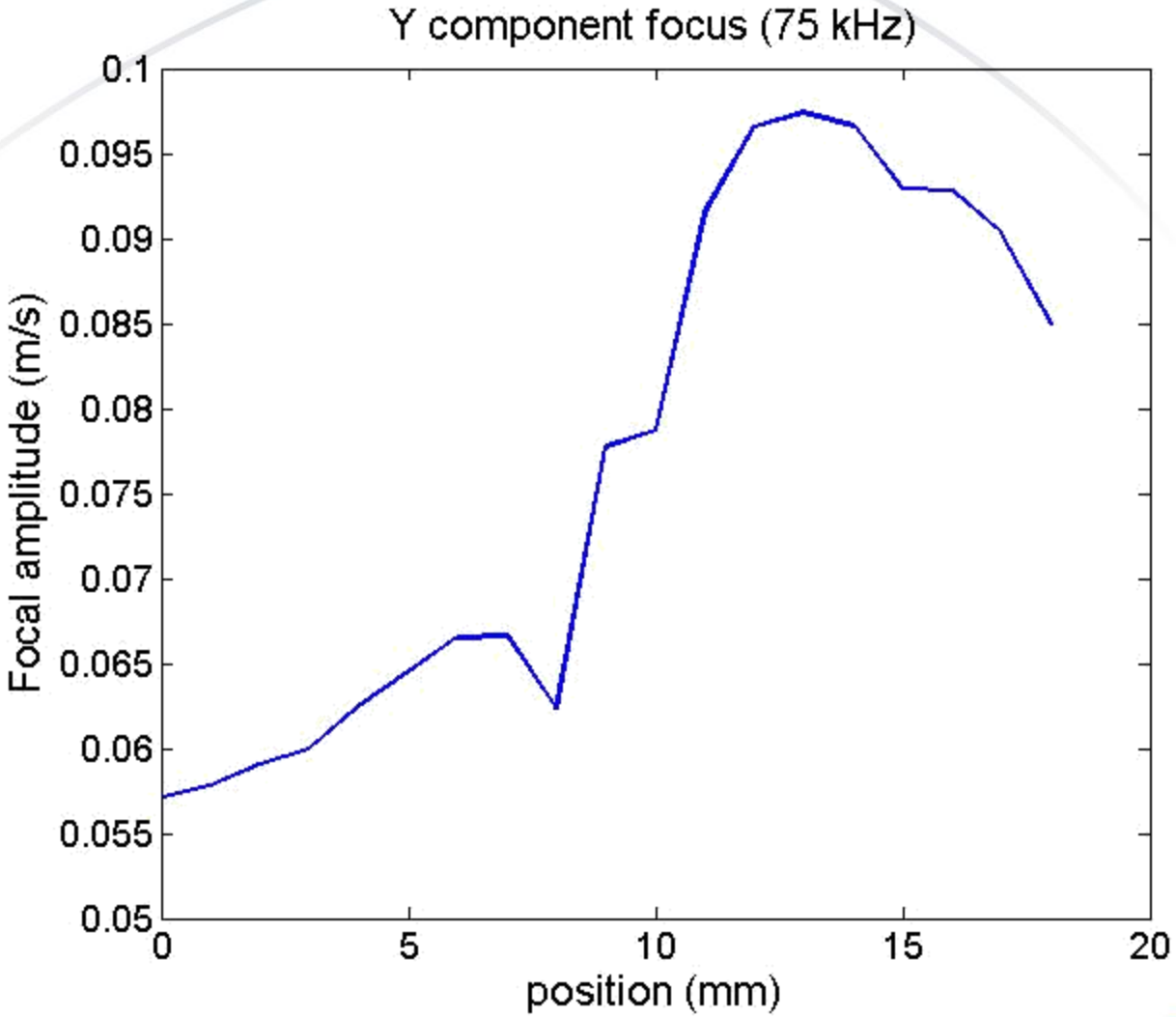


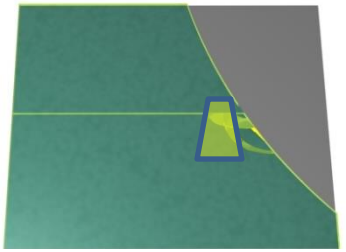
Linear image



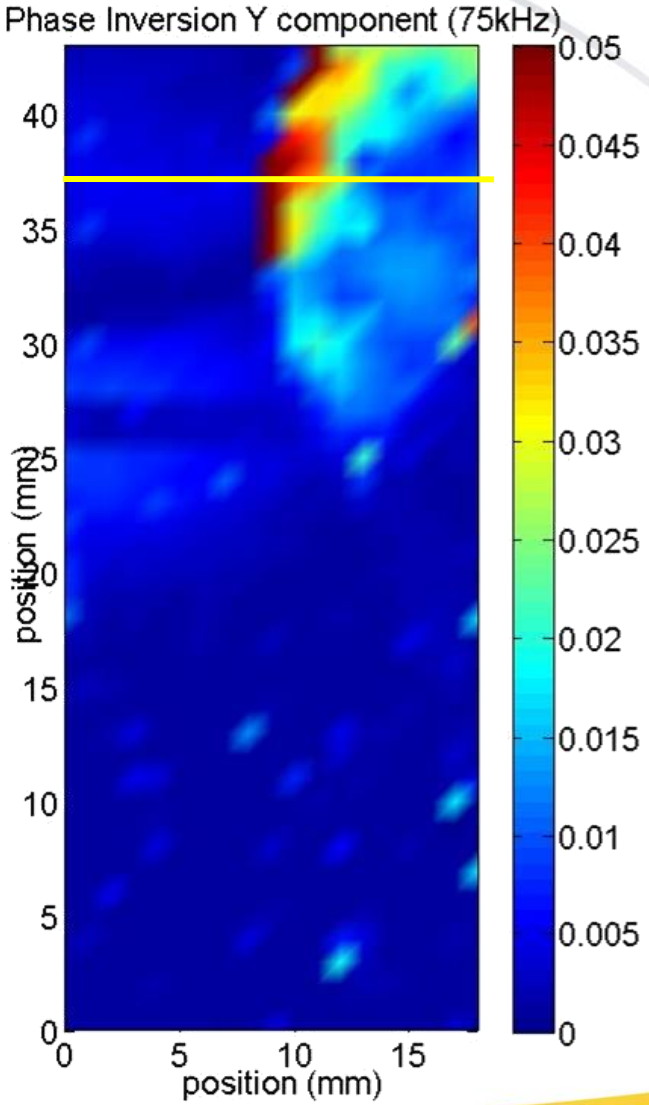


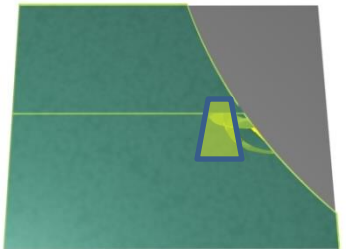
Linear image





Noninear image





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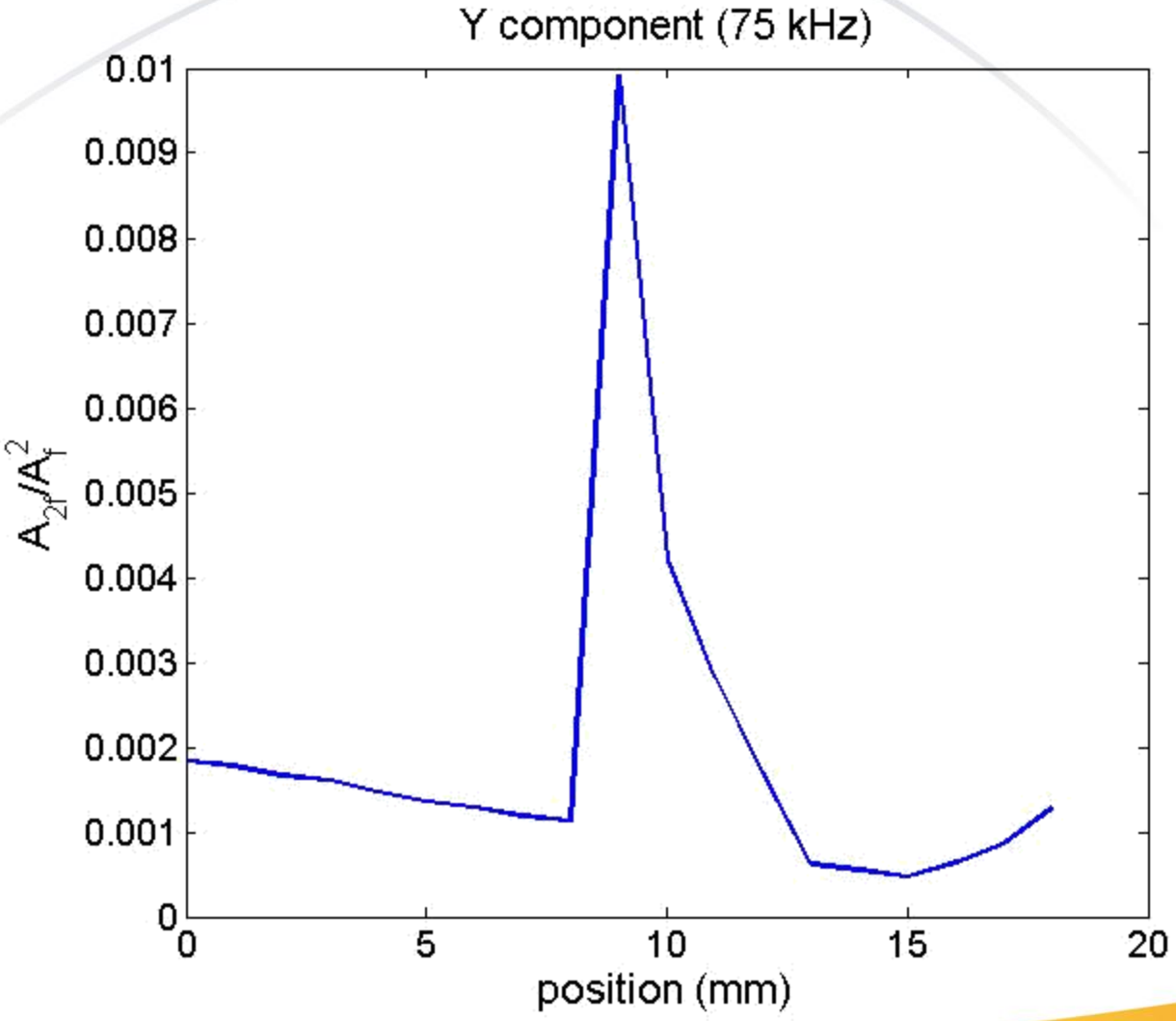

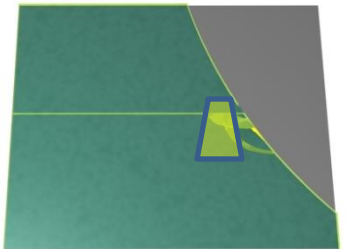

Selected component focus